California Energy Commission

2005 Natural Gas Market Assessment

Workshop on Natural Gas Market Assessment

2005 Reference Case

in support of

2005 IEPR

Natural Gas Office

July 14, 2005

Topics for the Morning Session

- Natural gas demand projections
- NARG modeling framework
- Natural gas supply and resource base assumptions and results
- Natural gas infrastructure implications
- Discussion on preliminary reference case

Overview of Analysis and Approach: Process

- Several workshops held to discuss input, assumptions and model details
- This workshop will present the results on the Preliminary Reference Case. Input from Parties will provide the Committee with information to make appropriate changes to assumptions and provide basis for the *Final Reference Case*
- Policy issues will be discussed in the afternoon session
- Input from this workshop will be considered by Committee for inclusion in the final reference case.
- Assumptions and results will be presented by the following order:
  - Demand - Lynn Marshall and Mark Digiovanna
  - Modeling framework - Leon Brathwaite
  - Supply - Mike Purcell
  - Infrastructure - Bill Wood
  - Prices - Mark Digiovanna

Natural Gas Model and Methods

Overview of Analysis and Approach

Forecasting and Modeling Analysis and Results

- Long-term market analysis
- Forecast horizon spans 10 years from 2006 to 2016
- Forecast developed on an annual basis
  - Previous (2003 IEPR and earlier) forecasts were developed on a five-year increment and results interpolated to give annual results
- Short-term and seasonal modeling aspects will be included in the next cycle of analysis
- Assumptions and inputs discussed with parties on several workshops and meetings

Overview of Analysis and Approach

- ***North American Regional Gas (NARG)*** Model used at the Commission since 1989
- This analysis uses the the MarketBuilder version
- Model consists of supply and demand basins connected by pipeline(s) or corridors of pipelines combined together
- NARG is an ***Equilibrium model*** that balances supply and demand at each node and at each time point
- Iterative solutions bring the model to a convergence
- California and Western States focus, but attend to the full North American market.
- Imports of LNG identified at various locations in the continent
- **New / expansion Projects included in the reference case only if they are permitted and under construction**

Overview of Analysis and Approach: Information Sources

- Sources of information and data are credible and have been debated in other forums
- Assumptions fall into 4 main categories:
  - Supply – Costs and Resource availability
  - Demand – demographic and economic parameters define demand projections for elastic demand in residential, commercial and industrial sectors and an inelastic demand for gas by power generation sector
  - Infrastructure – pipeline and distribution tariff, pipeline capacity, LNG facility capacity and LNG transportation costs
  - Other implicit factors are the oil price and market financial parameters such as interest rates, taxes, etc
- Following sections will provide the sources of information in each modeling area

Overview of Analysis and Approach: The Model

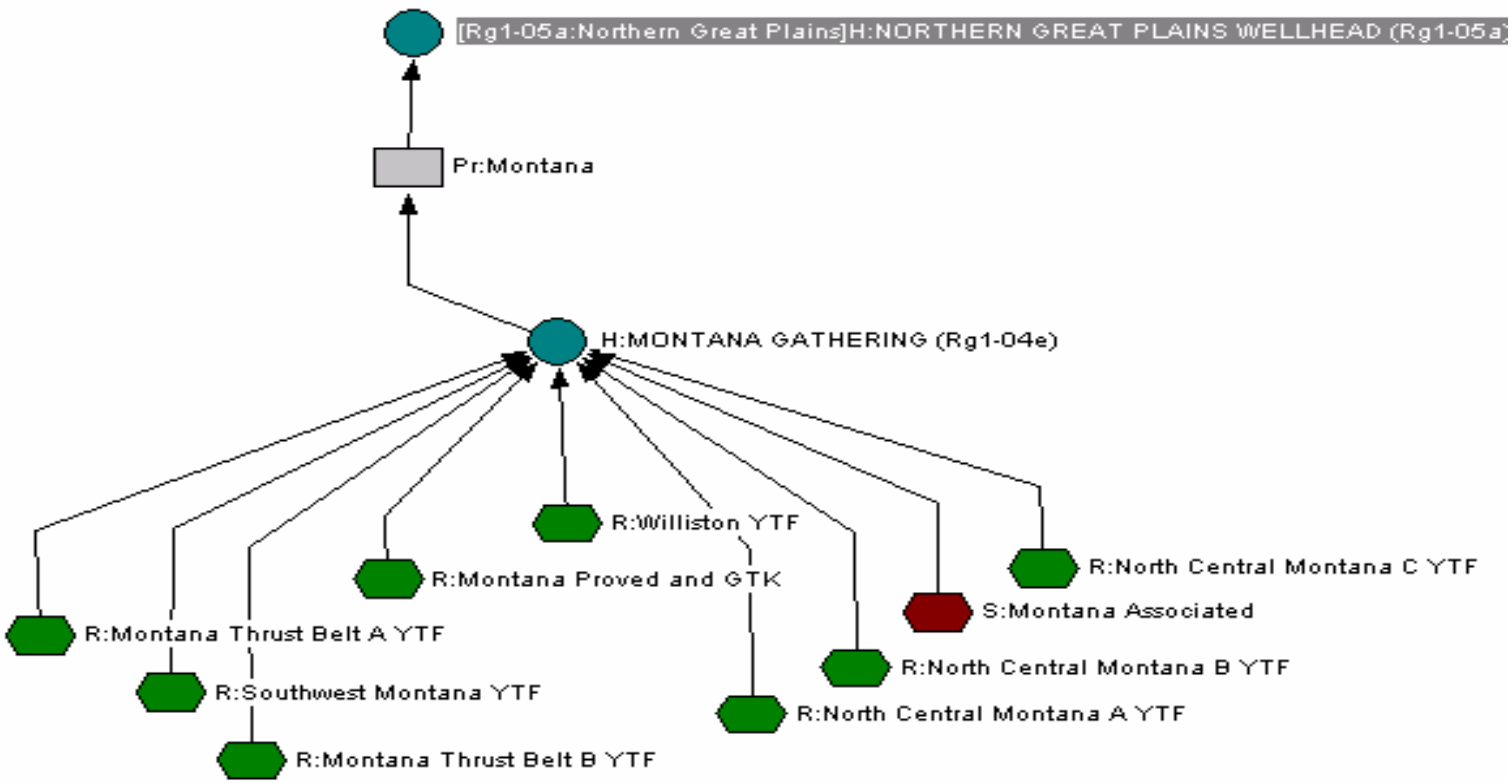
- Each sub-region contains activity nodes representing one or more of the following:
  - Demand (Residential, Commercial, Industrial (Chemical), Industrial (Non-Chemical) and Power Generation);
  - Supply;
  - Transportation (pipeline or pipeline corridor);
  - Processing/Conversion (gathering, LNG regasification).

Overview of Analysis and Approach: The Model (cont.)

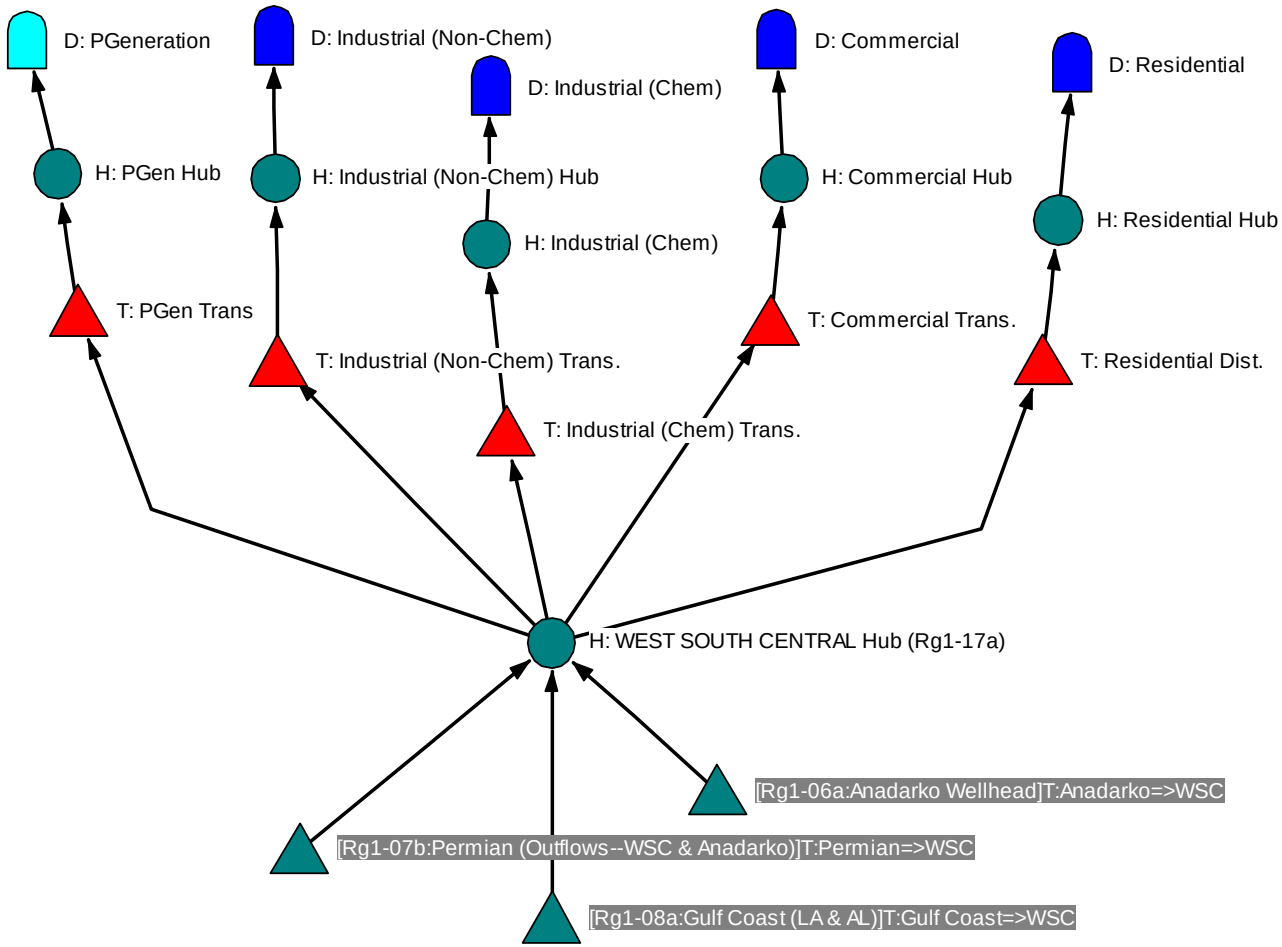
- **The North American Regional Gas (NARG) model is a generalized equilibrium model, calculating market clearing prices and quantities;**

- **The model finds prices and flows that give a simultaneous equilibrium in all time periods, in all sub-regions.**

Overview of Analysis and Approach: Sample Supply Region



Overview of Analysis and Approach: Sample Demand Region



Preliminary Reference Case Assumptions

- U.S. GDP Growth — 3.0%/year
- Canada GDP Growth — 2.5%/year

- Gas Demand Growth for Power Generation, WECC — 2.5%/year
- Residential, Commercial and Industrial — Elastic representation

- Gas Resource Base — NPC
- Gas Supply Curves — NPC/USGS

- ANS Gas Pipeline — In-Service 2013
- Mackenzie Valley Pipeline — In-Service 2010
- Crude Oil Price — EIA 2005 AEO – High A Case

- LNG thru 2010 — Operate & expand existing 4
  build 4 US East Coast/GOM, 1 Baja, 1 East Mexico

Natural Gas Supply

Topics

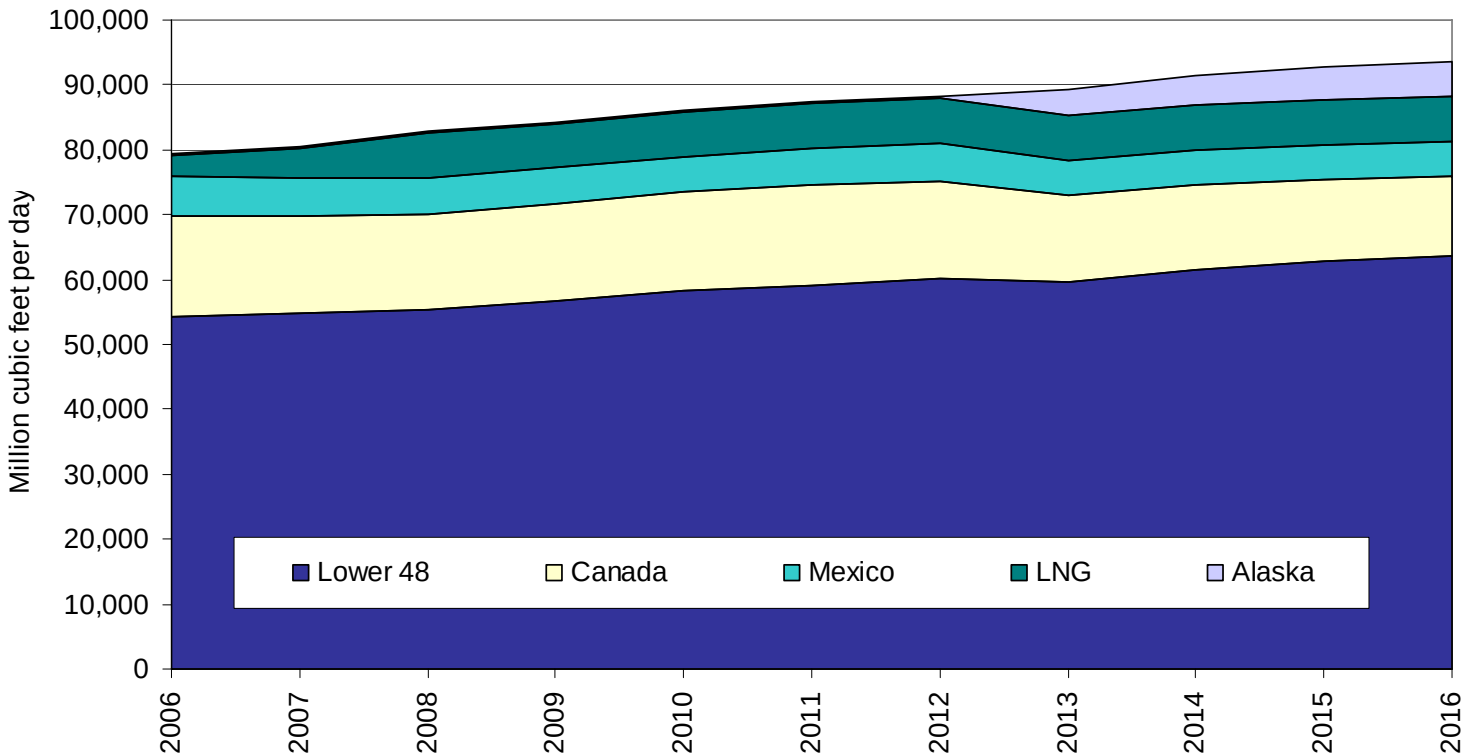
- **Supply Assessment;**
- **Projected Natural Gas Supplies Available to the United States;**
- **Changes in North American Production;**
- **Projected Natural Gas Supplies to California;**
- **Natural Gas Quality**

Supply Assessment

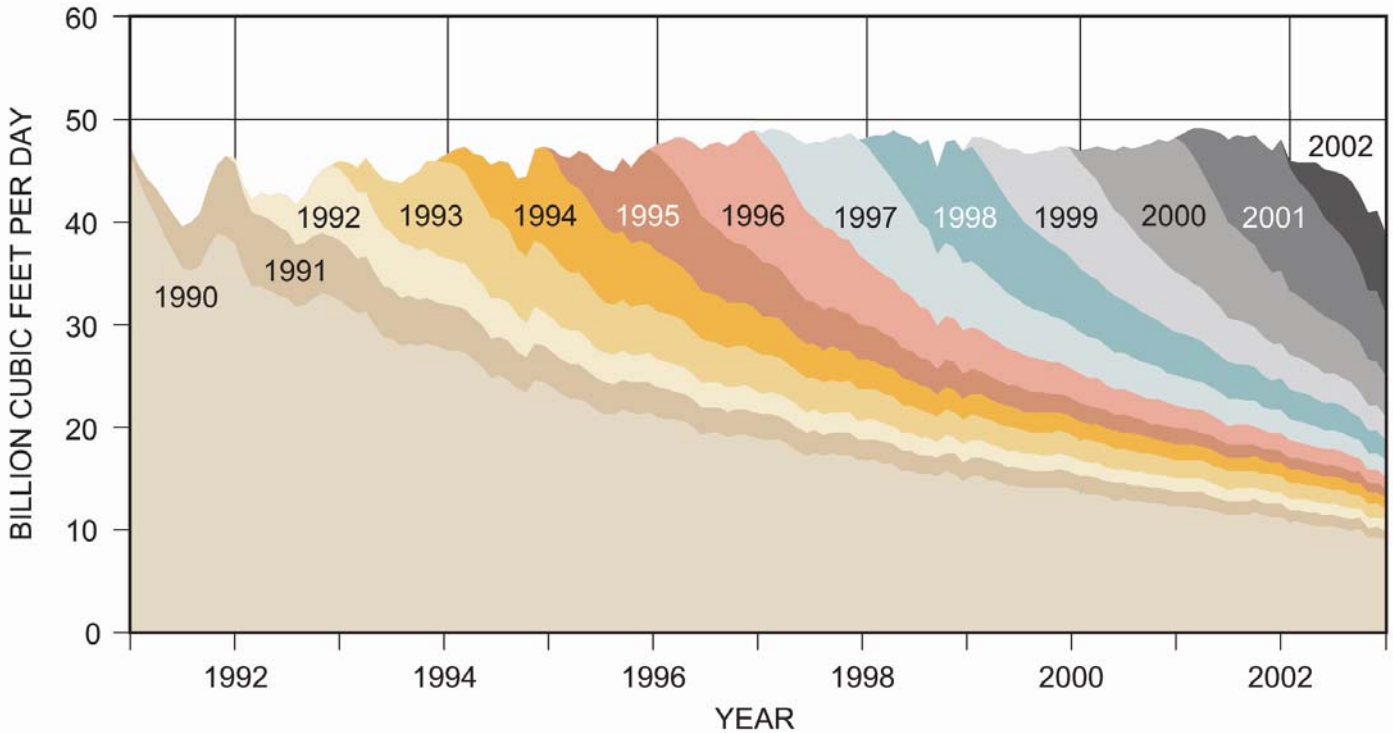
Data Sources:

- **National Petroleum Council**
- **United States Geological Survey**
- **Minerals Management Service**
- **Canadian Gas Potential Committee**
- **IHS Energy Group**
- **Industry**
- **Local Producers**

Gas Supplies Available to North America

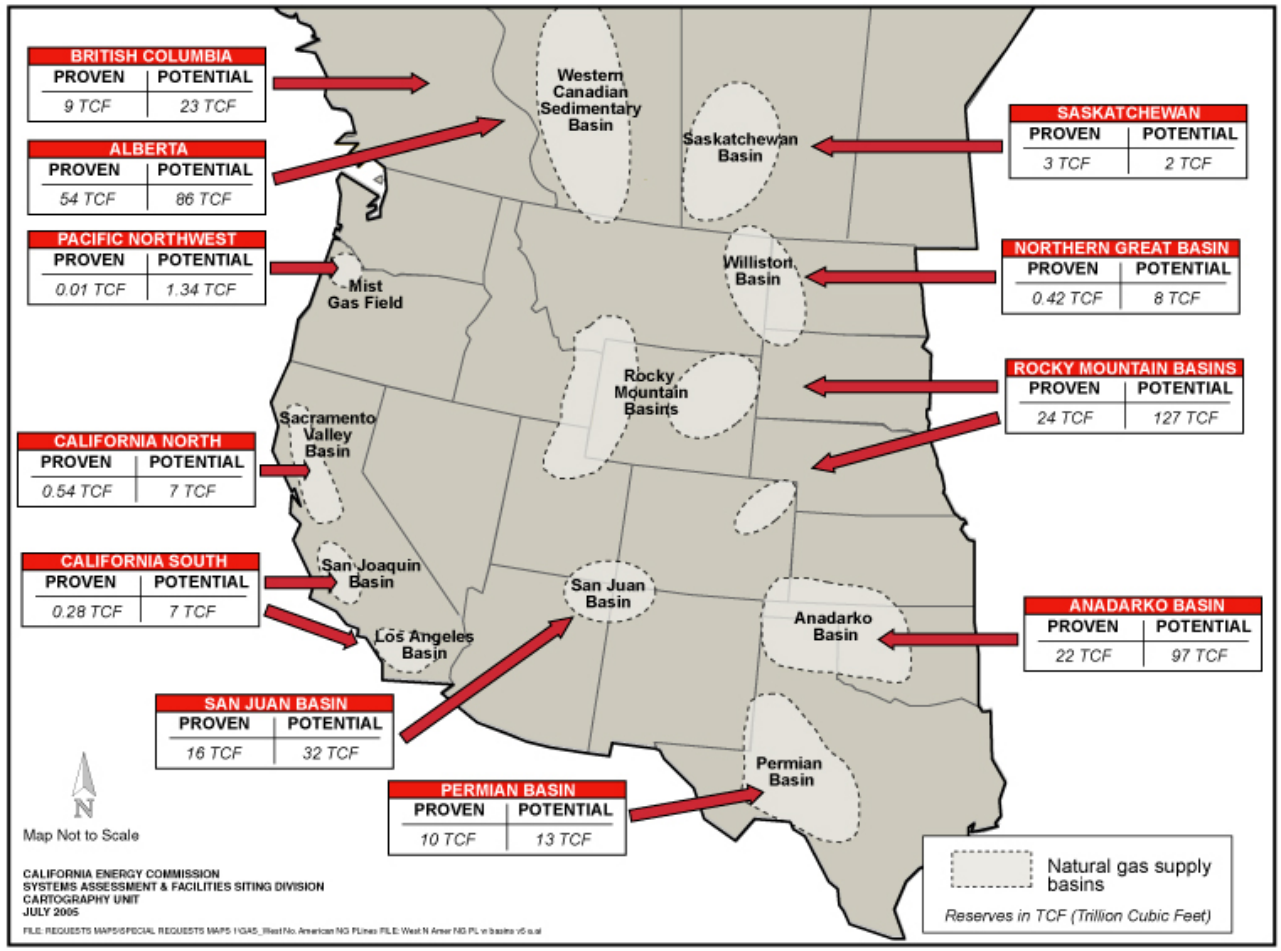


Decline of Production over Time for Gas Wells Drilled from 1990 through 2002

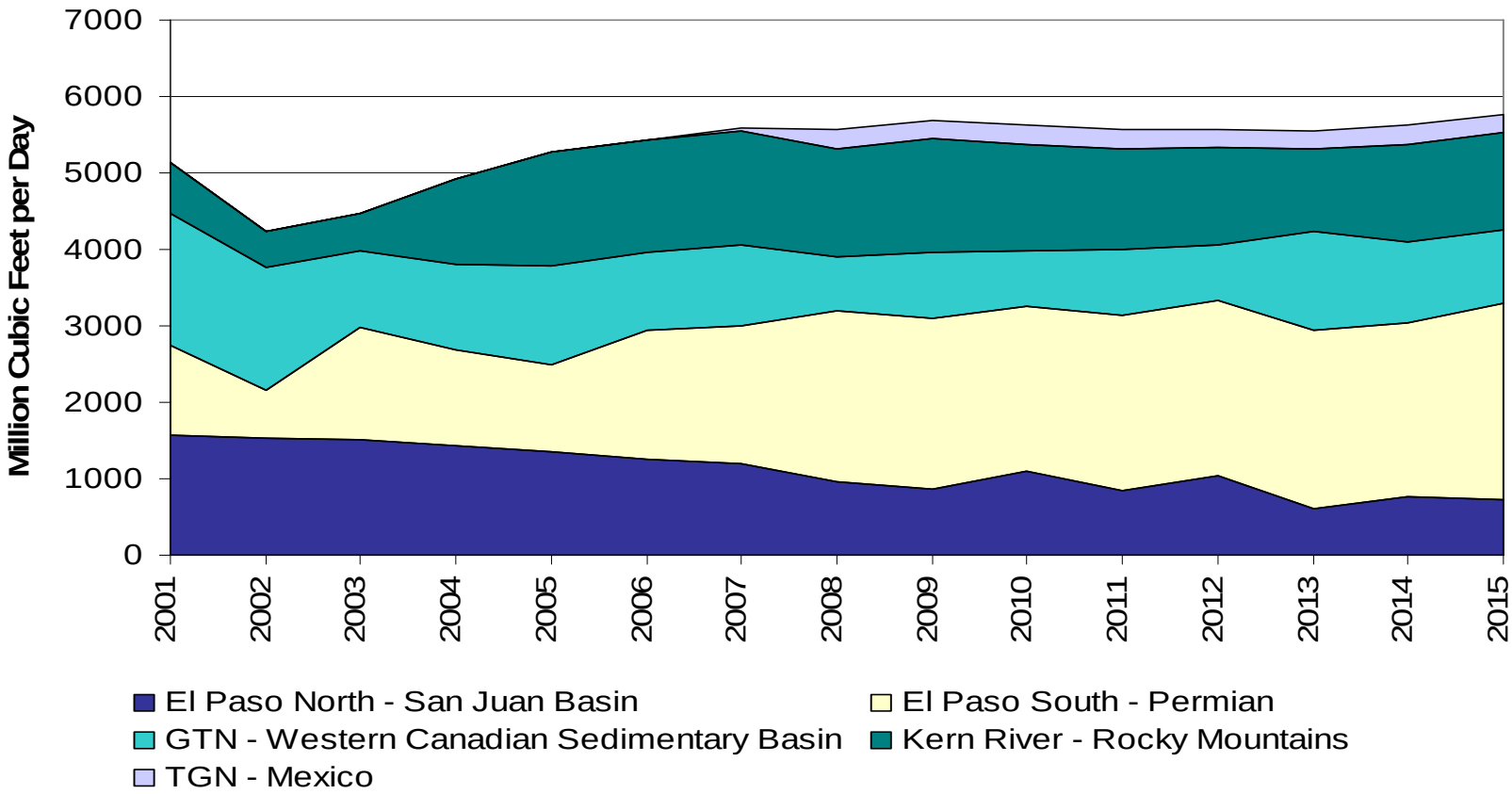


Source: IHS Energy Group.

Reserves for Basins Supplying Gas to the Western States



Gas Flows by Pipeline from Various Supply Basins to California



Natural Gas Quality

Natural Gas Variability

- Interstate Pipelines
- Southern California
- Northern California
- Potential Liquefied Natural Gas Imports

Implications

Natural Gas LNG Infrastructure

LNG Deliveries United States East Coast and Gulf of Mexico ($/Mcf)

Source/Destination	U.S. Gulf Coast	U.S. East Coast
South America East Coast	$2.50/$3.00	$2.20/$2.95
Africa West Coast	$3.20.$4.10	$3.50/$4.40
North Africa	$2.70/$3.55	$3.10/$3.95
Norway	$3.45	$3.70
Middle East	$4.05/$4.85	$4.50/$5.30

LNG Deliveries United States West Coast and Baja California Mexico ($/Mcf)

Source\Destination	West Coast
South America West Coast	$4.15
Asia/Pacific	$3.70/$5.25
Russia	$4.15
Alaska	$3.30

LNG Regasification Facilities (Billion Cubic Feet/Year)

Regasification Facilities	2005	2006	2007	2008	2009	2010
Everett	260	260	260	260	260	260
Cove Point	365	365	365	480	480	480
Elba Island	246	440	440	440	440	440
Lake Charles	475	475	475	475	475	475
Excelerate Energy Bridge	185	185	185	185	185	185
Port Pelican		584	584	584	584	584
Cameron			548	548	548	548
Quintana Island/Freeport			548	548	548	548
Altamiar, Mexico		237	475	475	475	475
Costa Azul, Mexico			365	365	365	365

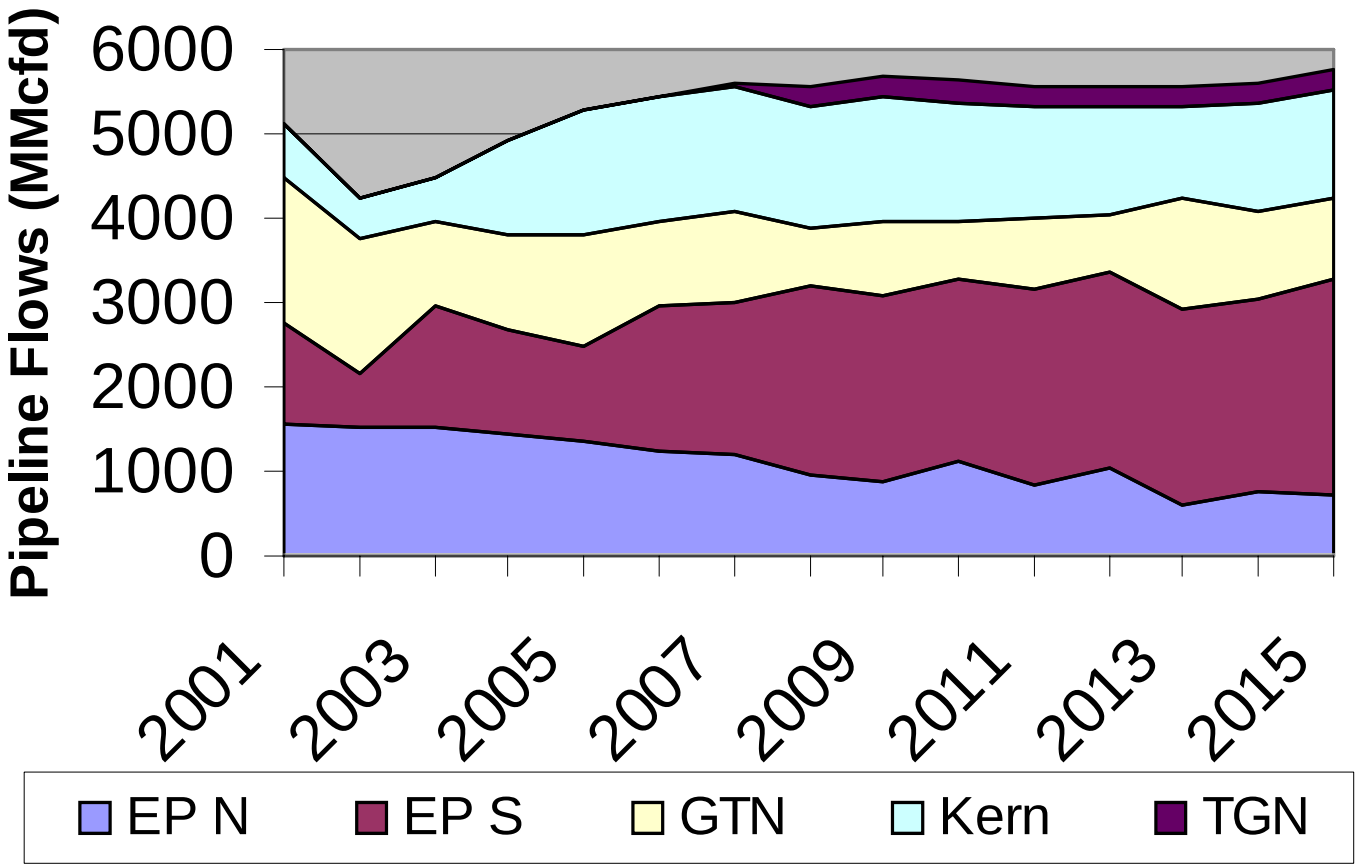
Natural Gas Pipeline Infrastructure

Interstate Pipeline Delivery Capacity to California

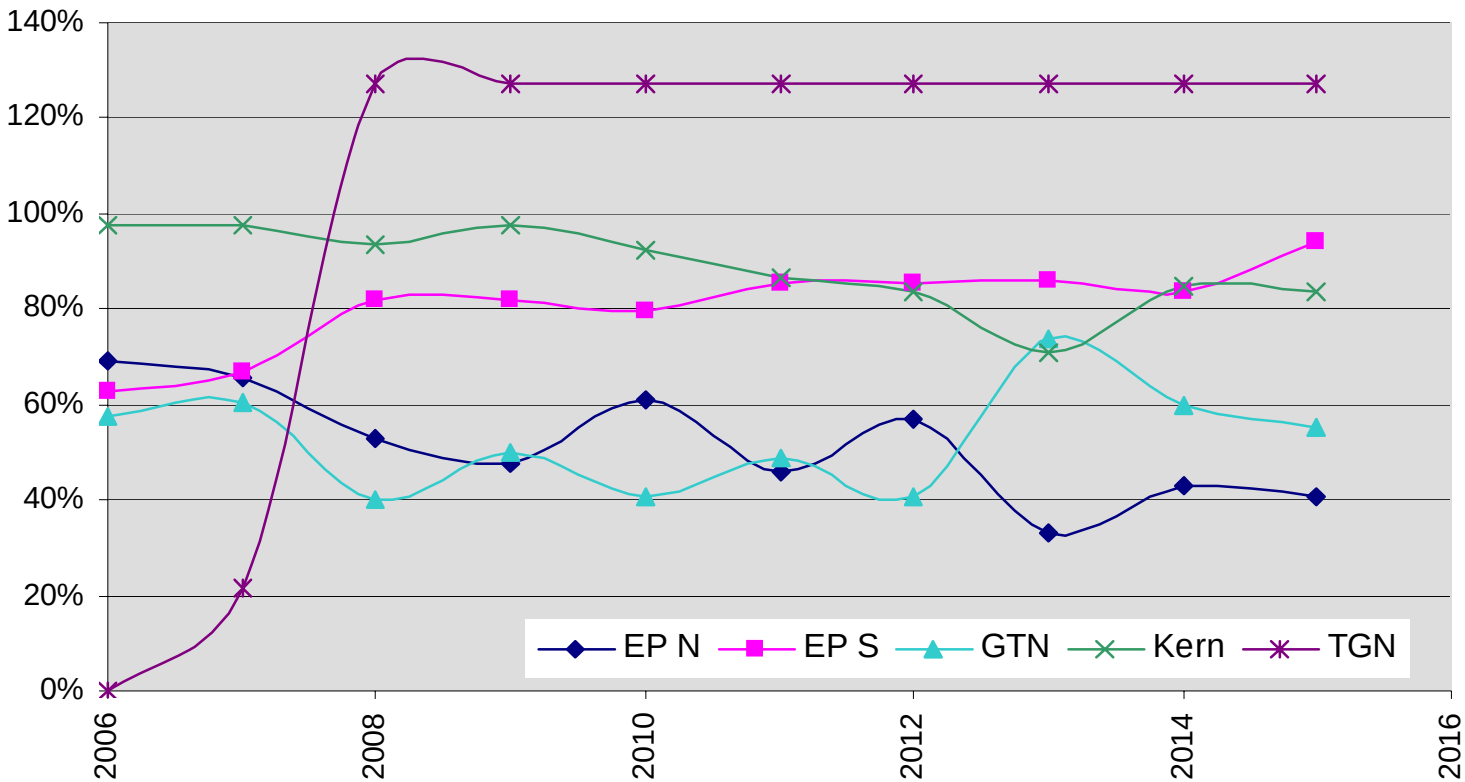
	MMcf per Day			
Pipelines Delivering Gas to California	**2001**	**2002**	**2003**	**2004**
Gas Transmission North	1,920	1,920	2,090	2,090
El Paso North	2,000	2,000	2,000	2,000
El Paso South	1,227	1,457	1,457	1,777
Kern River	835	835	1,735	1,735
Southern Trails		80	80	80
Transwestern	1,065	1,210	1,210	1,210
TGN	174	174	174	174
Sum of Delivery Capacity	**7,221**	**7,676**	**8,746**	**9.066**
California Receiving Capacity	**6,901**	**7,188**	**7,970**	**7,970**

Pipelines Passing Through California*				
Tuscarora	98	98	185	185
North Baja	500	500	500	500
Sum of Pass Through Capacity	**598**	**598**	**685**	**685**

Natural Gas Supply Projections (MMcf per day)



Interstate Pipeline Capacity Utilization



Conclusions

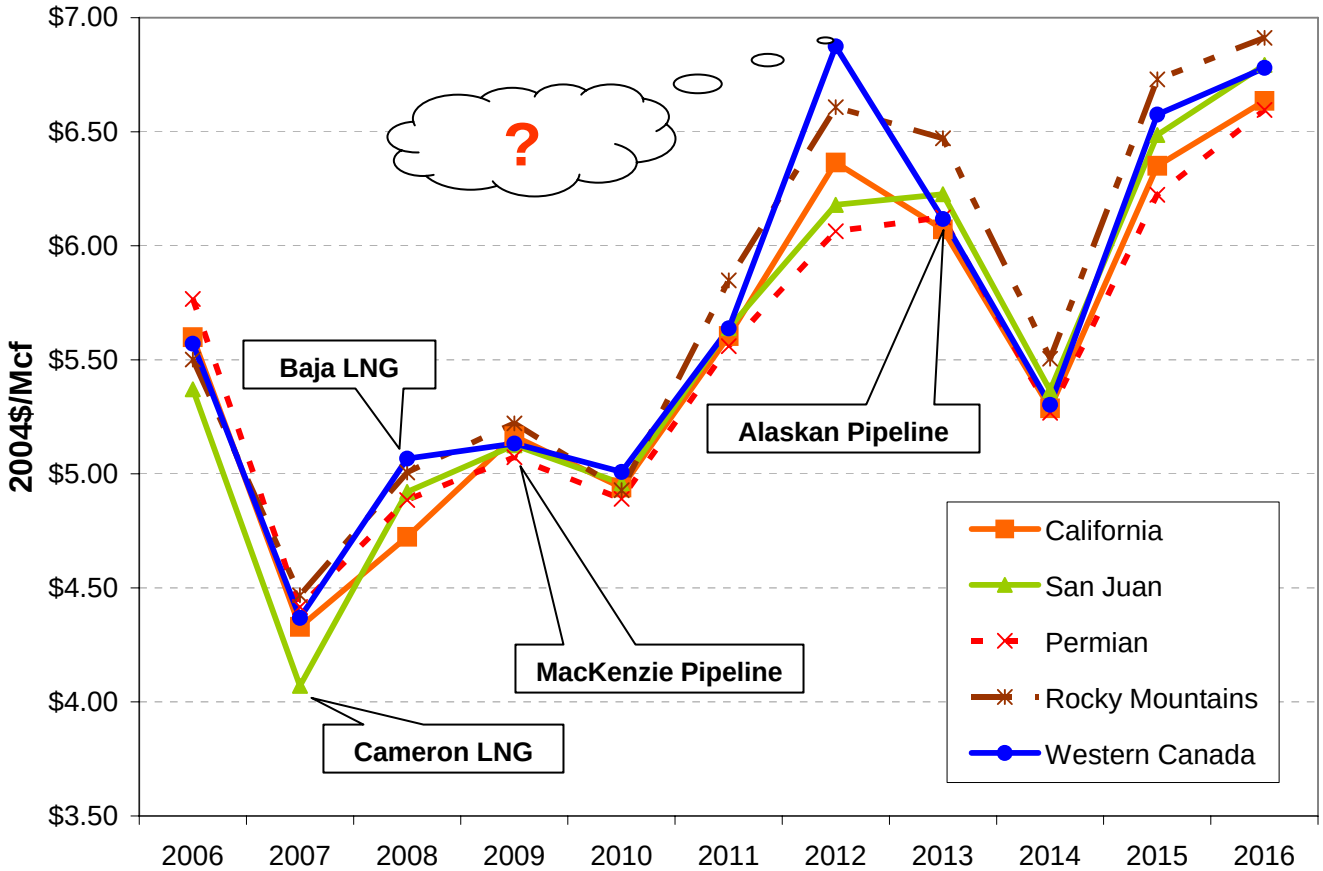
- On an average year basis, interstate pipelines serving California will meet all demand requirements.
- Increased deliveries to California will emerge from the reversals of Baja Norte (into Eherenberg) and TGN (into San Diego).
- The emergence of West Coast LNG as a supply source delays the need for new interstate pipeline capacity into California.
- Increasing Gulf coast LNG supplies displace Permian supplies, forcing it flow west to Southwestern demand regions increasing El Paso South pipeline utilization

Natural Gas Price

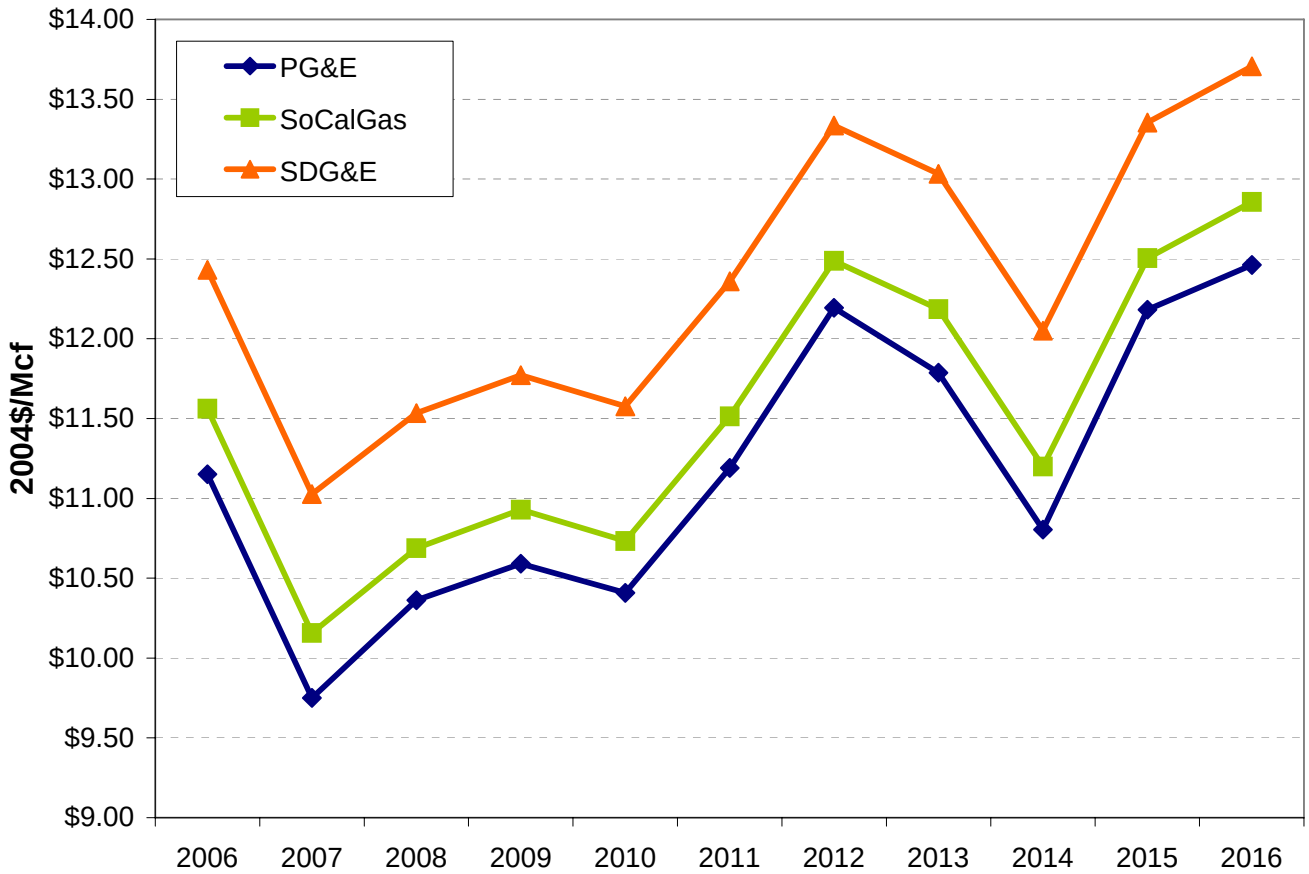
Today's Workshop Discussion

- Projected Wellhead Prices in the Basins Supplying California
- Natural Gas Prices for Residential Customers
- Natural Gas Prices for Commercial Customers
- Natural Gas Prices for Industrial Customers
- Natural Gas Prices for Electricity Generators
- Method Used to Convert Annual Prices to Monthly Prices for Use in the Power Generation Forecast

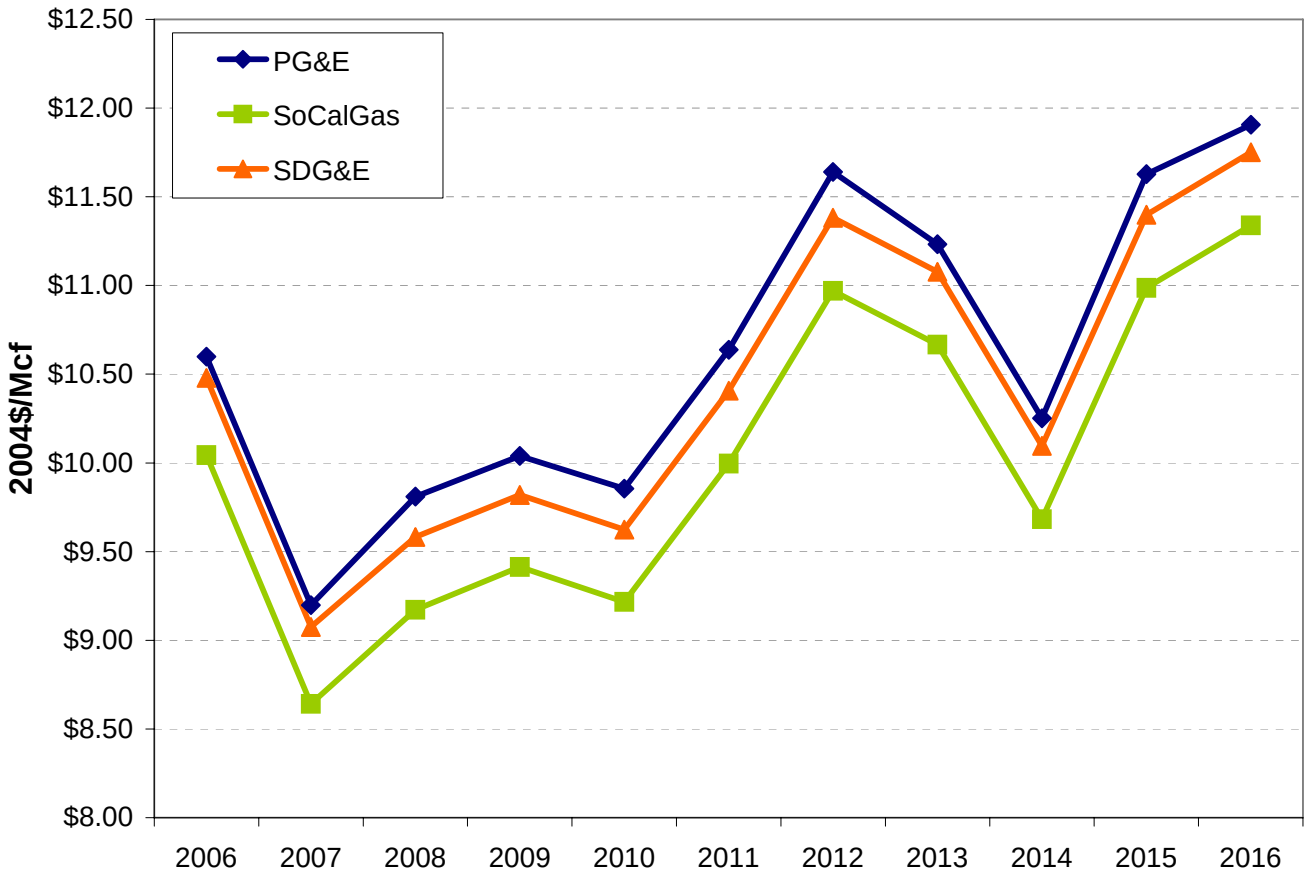
Wellhead Price Projections for the Basins Supplying California



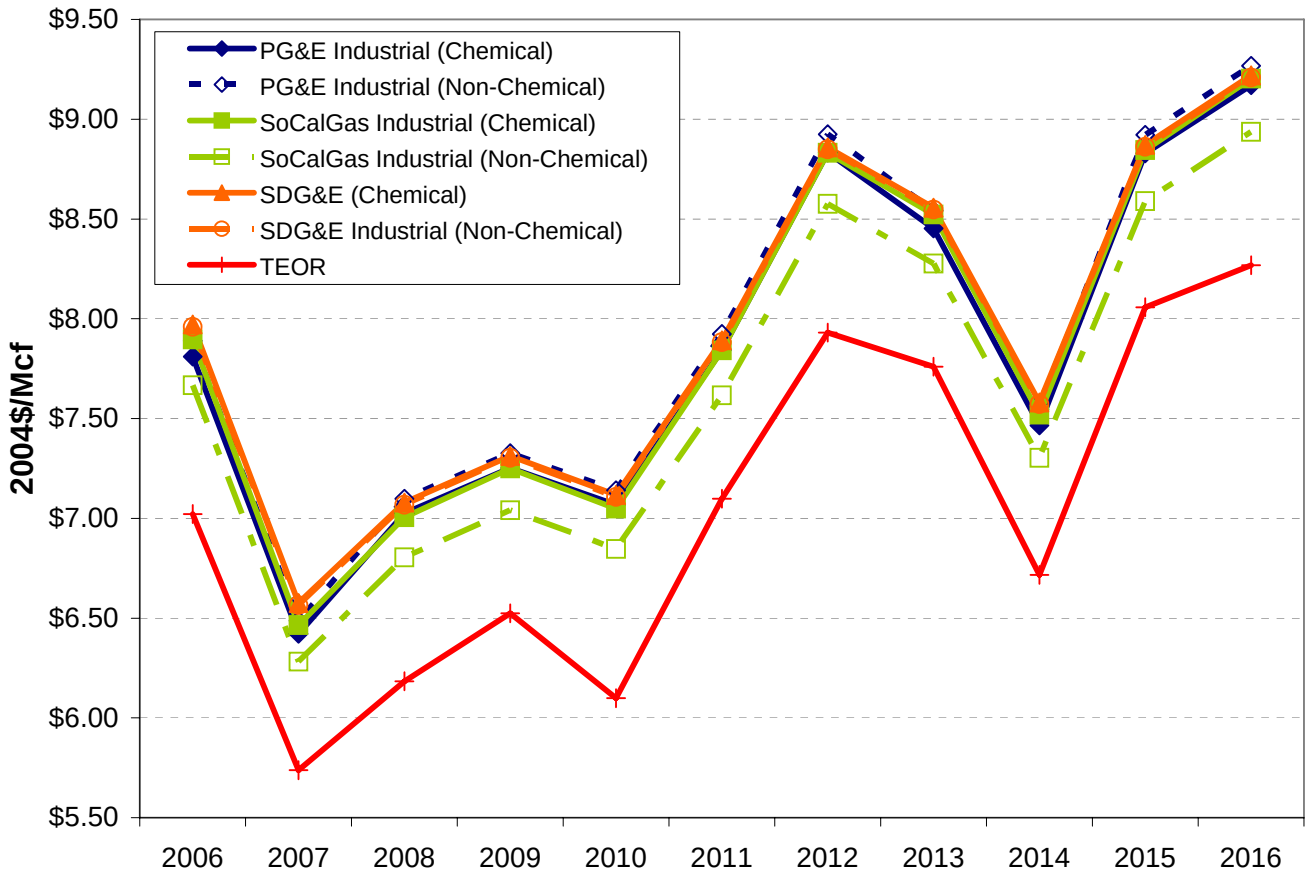
Projected Natural Gas Prices for Residential Customers



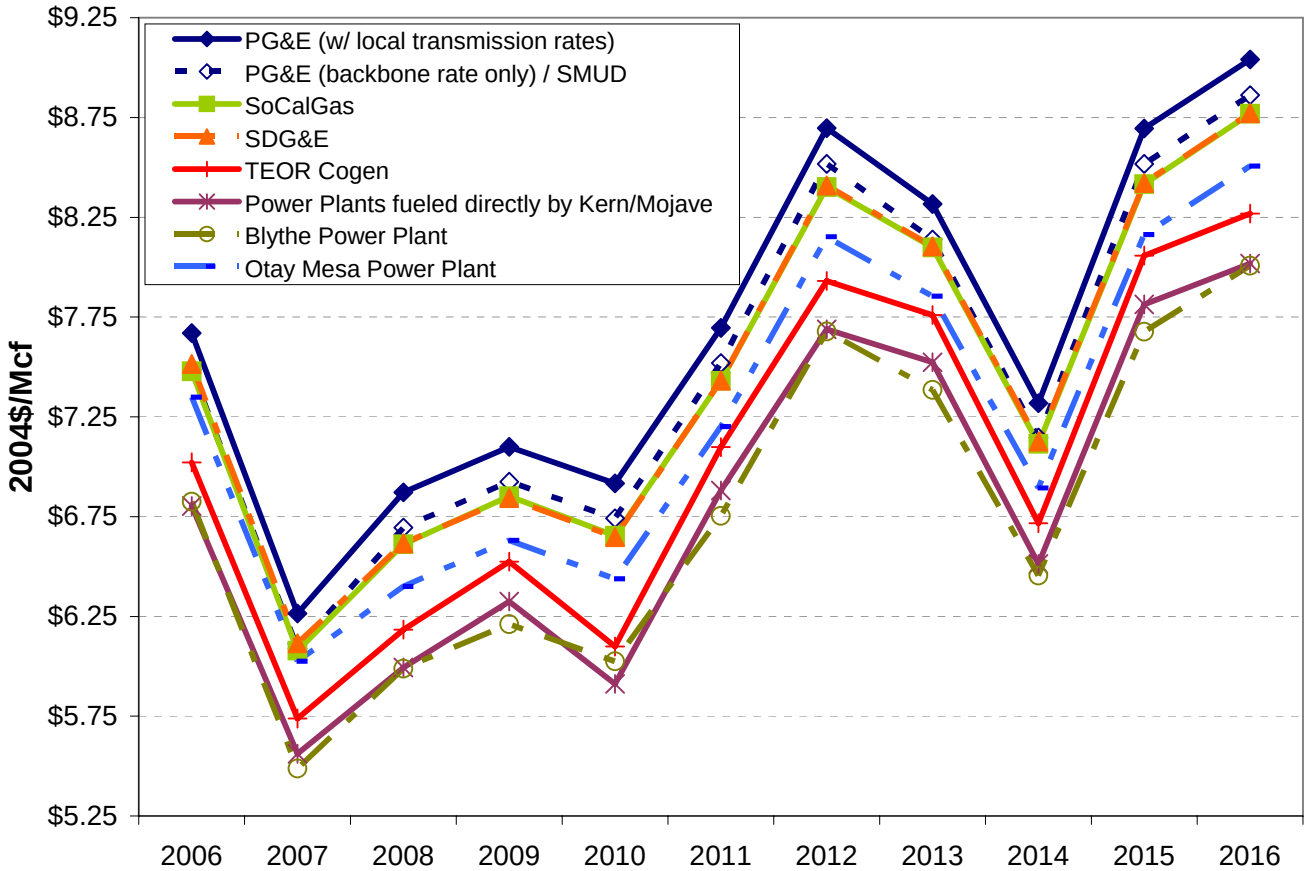
Projected Natural Gas Prices for Commercial Customers



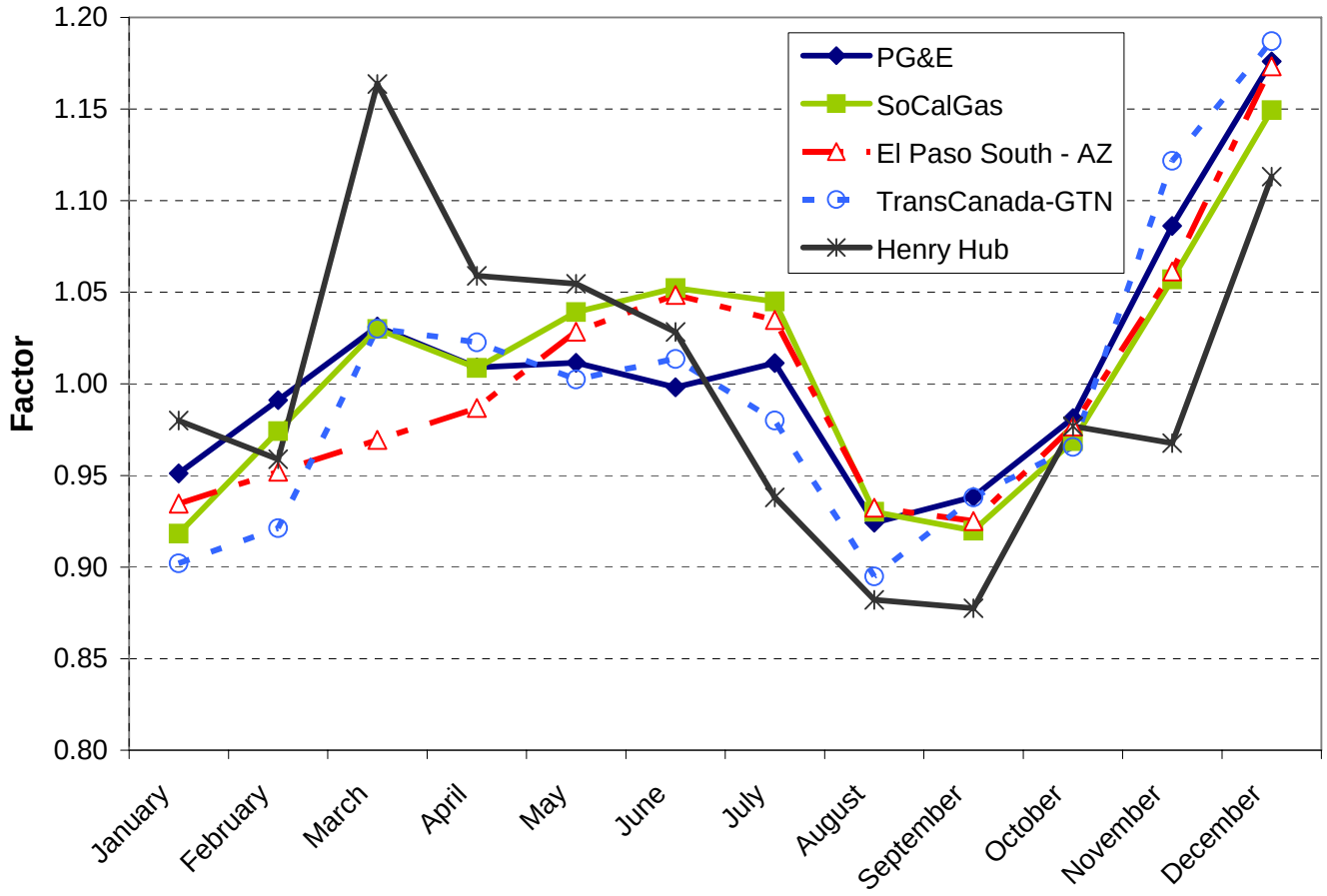
Projected Natural Gas Prices for Industrial Customers



Projected Natural Gas Prices for Power Generation Customers



Sample Yearly Profiles Used to Convert Annual Prices to Monthly Prices



Any questions…..?

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